

CLAIMS

What is claimed is:

1. A multiple-speed ratio automatic transmission for an automotive vehicle,
5 comprising:
 - an input shaft;
 - output shaft;
 - a planetary gear system comprising first, second, third, and fourth planetary gear units, each gear unit having a sun gear, a ring gear, planet pinions meshing with the sun gear and ring gear, and a carrier rotatably supporting the planet pinions;
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 - the input shaft being connected driveably to the sun gear of the first gear unit, the output shaft being connected driveably to the carrier of the third gear unit, the sun gear of the third gear unit and the sun gear of the third gear unit being mutually driveably connected, the carrier of the first gear unit and ring gear of the second gear unit being mutually driveably connected, the carrier of the second gear unit and ring gear of the fourth gear unit being mutually driveably connected, the ring gear of the third gear unit and carrier of the fourth gear unit being mutually driveably connected;
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 - a coupler for alternately holding against rotation and releasing the carrier of the fourth gear unit and the sun gear of the fourth gear unit;
 - 20 a first brake for holding against rotation and releasing the sun gear of the second gear unit;
 - a first clutch for driveably connecting and disconnecting the ring gear of the first gear unit and carrier of the second gear unit;
 - 25 a second clutch for driveably connecting and disconnecting the ring gear of the first gear unit and input shaft;
 - a third clutch for driveably connecting and disconnecting the sun gear of the fourth gear unit and the coupler; and
 - a fourth clutch for driveably connecting and disconnecting the sun gear of the first gear unit and ring gear of the third gear unit.

2. The transmission of claim 1, wherein the third clutch further comprises:
a friction clutch having a first element driveably connected to the sun gear of
the fourth gear unit, and a second element connected to the coupler; and
5 an overrunning coupling arranged in parallel drive relationship with the friction
clutch for producing a one-way drive connection between the coupler and the sun gear
of the fourth gear unit.

10 3. The transmission of claim 1, further comprising:
a torque converter including an impeller driveably connected to a power source,
and a turbine hydrokinetically coupled to the impeller and driveably connected to the
input shaft.

15 4. The transmission of claim 1, further comprising a transfer mechanism
including:
a second output shaft;
a first sprocket wheel;
a second sprocket wheel, spaced from the first sprocket wheel and driveably
connected to the second output;
20 a drive chain engaged driveably with the first and second sprocket wheels; and
a clutch for driveably connecting and releasing the first sprocket wheel and the
output shaft.

25 5. The transmission of claim 1, wherein the coupler further comprises:
a hub secured against rotation; and
a sleeve supported on the hub for axial sliding movement between a forward
drive position where the sleeve driveably connects the hub and the third clutch, and a
reverse drive position where the sleeve driveably connects the hub and the carrier of
the fourth gear unit.

6. The transmission of claim 5, further comprising a transmission case fixed against rotation, and wherein the hub is secured to the transmission case.

5 7. A multiple-speed ratio automatic transmission for an automotive vehicle, comprising:

an input shaft;

output shaft;

10 a planetary gear system comprising first, second, third, and fourth planetary gear units, each gear unit having a sun gear, a ring gear, planet pinions meshing with the sun gear and ring gear, and a carrier rotatably supporting the planet pinions;

15 the input shaft being connected driveably to the sun gear of the first gear unit, the output shaft being connected driveably to the carrier of the third gear unit, the sun gear of the third gear unit and the sun gear of the fourth gear unit being mutually driveable connected, the carrier of the first gear unit and ring gear of the second gear unit being mutually driveably connected, the carrier of the second gear unit and ring gear of the fourth gear unit being mutually driveably connected, the ring gear of the third gear unit and carrier of the fourth gear unit being mutually driveably connected;

20 a coupler for alternately holding against rotation and releasing the carrier of the fourth gear unit and the sun gear of the fourth gear unit;

a first brake for holding against rotation and releasing the sun gear of the second gear unit;

a second brake for holding against rotation and releasing the sun gear of the first gear unit;

25 a first clutch for driveably connecting and disconnecting the ring gear of the first gear unit and carrier of the second gear unit;

a second clutch for driveably connecting and disconnecting the ring gear of the first gear unit and input shaft;

a third clutch for driveably connecting and disconnecting the sun gear of the fourth gear unit and the coupler; and

a fourth clutch for driveably connecting and disconnecting the sun gear of the first gear unit and ring gear of the third gear unit.

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8. The transmission of claim 7, further comprising a transmission case fixed against rotation, and wherein the second brake further comprises:

a friction brake having a first element driveably connected to the sun gear of the first gear unit, and a second element driveable connected to the transmission case; and

10 an overrunning coupling arranged in parallel drive relationship with the friction brake clutch, for producing a one-way drive connection between the sun gear of the first gear unit and the transmission case.

9. The transmission of claim 7, further comprising a transmission case fixed against rotation, and wherein the second brake further comprises:

an overrunning coupling for producing a one-way drive connection between the sun gear of the first gear unit and the transmission case.

10. The transmission of claim 7, further comprising a transmission case fixed against rotation, and wherein the second brake further comprises:

a friction brake having a first element driveably connected to the sun gear of the first gear unit, and a second element driveable connected to the transmission case.

11. The transmission of claim 7, further comprising:

25 a torque converter including an impeller driveably connected to a power source, and a turbine hydrokinetically coupled to the impeller and driveably connected to the input shaft.

12. The transmission of claim 7, further comprising a transfer mechanism including:

a second output shaft;
a first sprocket wheel;
a second sprocket wheel, spaced from the first sprocket wheel and driveably connected to the second output;
5 a drive chain engaged driveably with the first and second sprocket wheels;
a clutch for driveably connecting and releasing the first sprocket wheel and the output shaft.

13. The transmission of claim 7, wherein the coupler further comprises:
10 a hub secured against rotation; and
a sleeve supported on the hub for axial sliding movement between a forward drive position where the sleeve driveably connects the hub and the third clutch, and a reverse drive position where the sleeve driveably connects the hub and the carrier of the fourth gear unit.

15 14. The transmission of claim 13, wherein the hub is secured to the transmission case.

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